ON THE ORIGIN OF ROCKETS

BY

JIXING PAN

Institute for the History of Science, Chinese Academy of Sciences, Peking

1. Where were rockets invented?

The invention of the rocket presupposes the existence and practical use of gunpowder, so it is not surprising that rockets in fact originated in China, where gunpowder had been invented and was in use for military purposes as early as the beginning of the 10th century. The *Wu-ching tsung-yao* 蒼經總要 ("Collection of Essential Military Techniques") by Tseng Kung-liang 曾公亮 (998–1078) and Ting Tu 丁度 (990–1053), published in 1044, describes nine kinds of gunpowder weapons and contains the three earliest precise recipes for the manufacture of gunpowder (Fig. 1).¹ According to the *Sung-shih* 宋史 of 1345² and the *Yü-hai* 玉海 of 1267,³ in 969 Feng Chi-sheng 馮繼昇, an official

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³ Wang Ying-lin 王應麟, *Yü-hai* 玉海, ch. 150, p. 122 (1879 ed.).
in the Northern Sung Ministry of War, presented the Emperor with models of ‘fire arrows’ (huo-chien). These correspond exactly to the weapon described in the Wu-ching tsung-yao, and were certainly a type of gunpowder weapon.

Rockets require gunpowder which contains at least 70% saltpetre and 20% charcoal, and under 10% sulphur. Such gunpowder was already in use in China in the early 12th century for the manufacture of fireworks (yen-huo 煙火) and firecrackers (pao-chang 爆仗). In 1119 K’ou Tsung-shih (寇宗奭) published a book entitled Pent-s’ao yen-i 本草衍義 ("Dilations upon Pharmaceutical Natural History"), in which he states that saltpetre (hsiao-shih 消石 or 硝石) was use to make fireworks. Meng Yuan-lao, in a work of 1147, records that a number of soldiers put on a display of fireworks and firecrackers for the Emperor, and Shih Su’s gazetteer of Shaohsing of 1201 describes firecrackers made of paper tubes filled with sulphur and other ingredients which were set off on New Year’s Eve and made a noise like thunder.

In his Wu-lin chiu-shih 武林舊事 (Institutions and Customs of the Old Capital (Hang-chou)) of 1270, Chou Mi 周密 (1232-1298) talks of a large firework display mounted on a high stand and connected with a general fuse, which was fired at the court in the first half of the 12th century (Fig. 2). In another work Chou also describes a special cracker called an ‘earth rat’ (ti lao-shu 地老鼠), a kind of primitive rocket, displayed to the Empress Dowager at the court, which frightened her by rushing wildly about the floor and running under her chair. Since this occurred at the very beginning of the 13th century, we may conclude that the Chinese already possessed the necessary technical knowledge for making rockets, and that probably they had already conducted a series of dangerous experiments in order to improve gunpowder and establish the best recipes for making it. No doubt many Chinese technicians and workers devoted their lives to this task.

There is no clear proof that gunpowder and rockets were known in any other country earlier than in China. J. Dubois (1765-1848) maintained that rockets were invented in India as early as 300 BC, on the grounds that the ancient Sanskrit classic, the Rāmāyana,